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# THE MOSCOW-GOR'KIY DECIMETER-WAVE COMMUNICATIONS LINE

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/Comment: The following is the complete text of an article contributed by Engr M. U. Polyak to Radiotekhnicheskiy Sbornik, a symposium on radio engineering questions published in 1947./

(Author's abstract: The fixed radio relay line which is now being constructed between Moscow and Gor'kiy is to be used as an experimental line for testing new systems now under development. Towers 100 meters high have been used on the line, making it possible to extend the distance between separate relay points to 83 kilometers. In addition, the use of these towers will make possible studies on the progagation of decimeter and centimeter waves.)

Construction of the Moscow-Gor'kiy experimental radio relay line will be completed in the current year /1947/. Equipment is being installed which will provide for transmission of ten telephone messages simultaneously, including a service channel. Since any telephone channel can be used to organize three telegraph channels, this equipment, within its capacity limitations, will satisfy the need for both telephone and telegraph communications.

The builders have foreseen the possibility of installing several sets of 12-channel equipment on the same towers, using the same buildings. This will make the cost per channel-kilometer very low.

The planners of the Moscow-Gor'kiy line have encountered a number of difficulties, since they have not been provided with the materials which would permit them to adopt the soundest technical solutions. Planning of the line



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began with a detailed topographical and general survey of the entire route, which was conducted from large-scale maps by expeditions to study the hills, power systems, and communications enterprises along the route.

The goals at which the planners aimed were as follows: (1) finding a solution which would keep the number of relay stations needed to a minimum; (2) constructing the maximum number of stations at points where a steady 24-hr ac supply was available; and (3) combining the maximum number of relay stations with communications enterprises on the line, particularly with repeater and termination stations of wire communications lines.

In practice, it turned out that these conditions were mutually exclusive in some cases; but clear formulation of the problem made it possible to work out a compromise which satisfied the three requirements to the maximum possible degree.

Several possibilities were presented for preliminary consideration, i.e., variations employing 8, 7, 6, and 5 relay stations. A detailed comparison of all possibilities revealed the advantages of the one with six stations spaced 60 km apart on the average. By careful use of hills and elevations, geometrical visibility between all the peaks of adjacent towers could be obtained when five towers 80-100 m high and one tower 70 m high were used. To establish a certain safety margin and to follow the recommendations obtained as a result of a Central Scientific Research Institute of Communications Study, it was decided that the five identical 100-m metal towers available to the construction should be erected on the line. It was further decided that the metal tower of an operating radio station would be used as the sixth support. The doubts which existed as to the possible effect of the radio station's field on the operation of the decimeter-wave equipment of the radio relay line were dispelled by special experiments conducted on this section of the line.

The terrain and other factors prevented uniform spacing of the stations along the route; the maximum distance between stations was 83 km and the minimum distance, 33 km.

Experiments on the section of the line completed first provided experience for the solution of a number of problems. For example, it was found experimentally that communications reliability was considerably improved when quadrupled five-dipole arrays were used instead of a single or twinned five-dipole array. This confirmed theoretical calculations, and it was decided that quadrupled five-dipole arrays would be used at all relay stations.

A reliable ac power supply for the equipment was found for four stations on the line. Independent power-supply units, each consisting of two small diesels, a rectifier, a storage-battery, and a reversible motor-generator, were used at two stations. One of the two diesels will operate several hours per day to supply the equipment, charge the battery through the rectifier, drive the motor generator (unloaded), and produce power for lighting and other needs. When the engine is stopped, the rotating motor generator is automatically connected to the battery and takes on the load. This unit will provide a reliable and convenient supply for the equipment.

The line will have a service channel, which will be of great convenience to the operating personnel. In addition, the possibility of communication with repeater stations along wire communications route has been provided for.

The average distance between relay stations on the line is much greater than that recommended in foreign literature; the tower heights used also exceed foreign recommendations. This is not accidental but is explained primarily by the fact that most foreign recommendations apply to lines with unattended relay stations, while the relay stations along the Moscow-Gor'kiy

line will operate for a considerable period with watch personnel, i.e., until sufficient experience is accumulated. There are other, possibly less important, factors which make our practice different from foreign practice. The erection of high towers made it possible to eliminate at least two relay stations, and created height reserves on almost all sections of the line. These reserves will make possible a number of very important experimental studies.

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